Programming Assignment #1
Heightmap

CSE 458 Computer Graphics, Fall 2010

1 Introduction

Your first assignment will require you to learn some basic OpenGL and GLUT functions. You will create a surface mesh in which height is determined by pixel values in an image called the heightmap. You will use OpenGL to render this mesh inside a skybox, a cube with scenery texture on the faces. You will use the GLUT toolkit for interaction with the mouse and keyboard to give the user interactive control over motion and rotation of the camera, as well as the ability to interactively scale the scene along the X, Y, or Z axis.

You must submit working code, example output (including a video), and a readme file explaining whether or not you met each requirement and detailing any extra credit you added. The readme file is important! Your grade may suffer if you do not include one!

2 Heightmap

You will use the pic.h library to read a jpg file, such as A in Fig. 1. The intensity (grayscale) values of pixels in this image will serve as height values for nodes in a triangle mesh (B in Fig. 1). This will create a detailed terrain. When rendered with OpenGL, this will look like a surface of a landscape (C in Fig. 1). The pic.h library will allow you to read RGB pixel values from a jpg file. There is an example of this provided in the starter code. There are also two images provided, hflab4.jpg and spiral.jpg, that you may use as your heightmaps.

3 Skybox

Your surface mesh will be contained in a skybox: a cube with textures of ground, horizon, and sky that fit together to appear as a seamless large environment. Six jpg files that form a skybox are included in the starter

Figure 1: An Example Heightmap and Surface Mesh

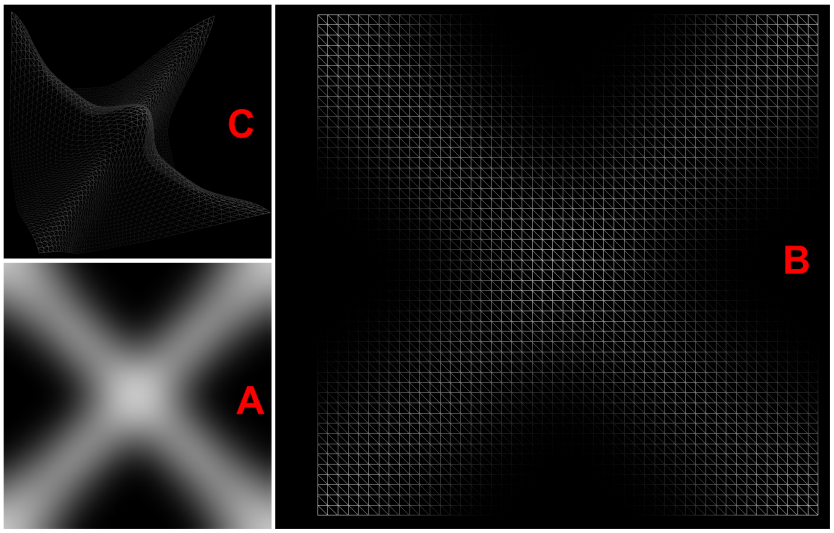
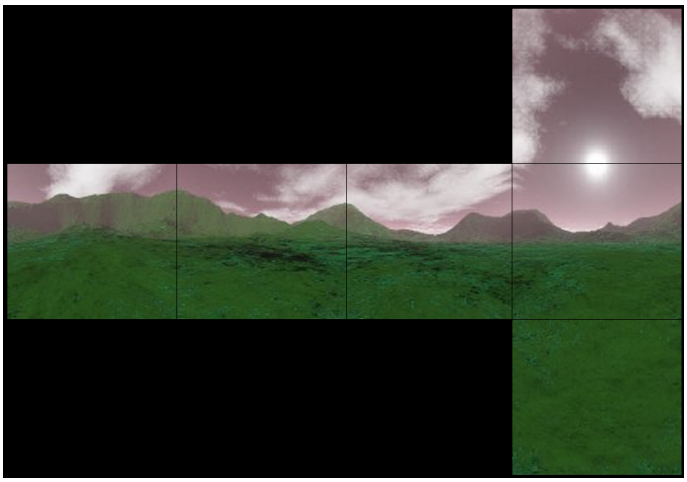


Figure 2: A Set of Skybox Textures, Flattened



code. You will read each one of these and load it as an OpenGL texture. You will draw six quads to form the sides, each textured with one of the images provided. An example of loading a texture and drawing one textured

quad is already in the starter code. To give your skybox a more realistic effect of being infinitely far away, you may choose to have it be unaffected by translation of the camera. Thus, no matter how far you move, the skybox will never get closer.

4 Interaction

The GLUT toolkit provides means of keyboard and mouse interaction through callbacks. This means that you define a function, such as 'keyboard' in the starter code, and pass that function as a parameter to a glut function, such as 'glutKeyboardFunc' in the starter code. Then, while 'glutMainLoop' is still working, keys pressed will trigger the 'keyboard' function that you defined.

In your project, mouse movement will control the movement and rotation of the camera, as well as the scaling of the environment. When 'CTRL' is held, mouse movement should move the camera, when 'SHIFT' is held, mouse movement should scale the environment, when neither is held, mouse movement should rotate the camera. The starter code handles these condition and updates three global variables, 'currentTranslation', 'currentScaling', and 'currentRotation', based on mouse movement. However, these variables are currently unused. You will have to edit the 'display' function so that it uses 'glTranslatef', 'glRotatef', and 'glScalef' to adjust the scene properly.

5 Extra Credit

The functionality described above will be scored out of 100 points and is worth 10% of your course grade. You may earn up to 30 points of extra credit. Anything above the requirements will be considered for extra credit; the more impressive, the more points you will earn. Do not forget to describe your extra credit efforts in your readme file! Possible ideas include learning how to turn on lights and set light and material properties for more realistic or otherwise visually interesting terrain, learning how to set up shadowing, including GLUT primitive shapes like spheres, cones, or cylinders, or anything else you would like to learn and implement in OpenGL, as well as anything that shows you understand something related to the course content (perhaps the importance of the order of operations in matrix algebra?).